support two of the most widely cited models in biodiversity research; niche partitioning and adaptive radiation.

Many Amazonian fish genera are represented by 10 or more species living together — cheek by jowl — in multi-species assemblages. Even the specialist can hardly tell them apart; they often have very similar shapes and sizes, diets and microhabitats. In the face of this exuberance arguments for competitive exclusion, or one species, one niche are hard to sustain. Further, recent molecular, biogeographic, and paleontological data suggest that most Amazonian fish genera are ancient, dating back tens of millions of years, to a time before the geological assembly of the modern Amazon basin.

Phylogenetic analysis has shown that the closest relatives of floodplain species frequently inhabit non-floodplain streams and rivers. In other words, the co-existence of numerous ecologically similar species in floodplain floating meadows is the result of multiple independent invasions of this habitat, not *in situ* speciation. Niche partitioning and adaptive radiation may be real in Neotropical floodplains and, if so, the signals they yield are quickly overwhelmed by exceptionally high rates of other evolutionary phenomena.

Amazonian floodplains extend over 180,000 km^2, a little larger than the area of England and Wales combined, or about 2.6% of the 7 million km^2 area of the entire basin. I doubt that we as a community will fully document the species of this immense area within my professional lifetime, let alone that of the entire biosphere. But I dare say it is not impossible.

An all-species survey will necessarily be a collective effort — on a scale of the NASA Mars program, or the Human Genome initiative. It will require a collaboration of traditional morphological and biogeographical approaches with novel bioinformatic, remote sensing and genetic technologies. What we most urgently need however is really just a great deal more of what we already have; more taxonomists, more students, more collaborations, more surveys, more museums, more work. We have a good idea of what such a determined effort will yield; pay-off in everything from resource management to basic scholarship. Perhaps such an enterprise could be one of the great contributions from our generation.

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Smell those spots

A widespread strategy among prey species unpalatable to their potential predators, is warning colouration advertising the fact. Research suggests that this has evolved because predators learn more quickly to avoid distinctively marked unpalatable prey than those which give out no such warnings. But interestingly, many species that carry warning colouration also have a second defence strategy: some bees, for example, emit a sound when threatened by a predator and ladybirds emit a particular odour. Why do these organisms use two defensive strategies?

New work carried out by Candy Rowe, at the University of Newcastle, reported in the Proceedings B of the Royal Society, London, (vol. *269*, p1353-1357) suggests that the two signals act together to speed up the unpalatability message. She tested chicks in the laboratory. Birds were trained to look for food rewards under coloured paper hats scattered in an experimental arena. They learned to discriminate between rewarded and non-rewarded hats. But half of the birds heard a sound when they attacked a non-rewarding hat. Rowe found that the presence of the sound improved the speed of colour discrimination. This demonstrates that there could be a selective advantage for potential prey species to emit a second signal when attacked as avian predators may learn to avoid them more quickly. Two strings to a defensive bow might therefore be a sound investment.

Warning signs: New research suggests that multiple signals may help protect prey from potential predators. (Picture: Science Photo Library.)